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Published by
NATIONAL LUBRICATING GREASE INSTITUTE

VOLUME X NUMBER 2 MAY, 1946

U. S. Army Specifications for Wheel Bearing Lubricants

By: Lt. Col. N. W. Faust

The experience of the Army with wheel bearing lubrication in general has been satisfactory because of the "know how" of the grease industry and because of the efforts made by the Ordnance Department to anticipate and thus prevent trouble. The history of wheel bearing lubrication as reflected by the various issues of U. S. Army Specification 2-108 and No. 2-110 has been discussed previously.[1] This discussion, therefore, will be limited to the present efforts being made to prevent a recurrence of sporadic difficulties which can be attributed to the lubricant.

When consideration was given to further improvements in the quality of General Purpose Grease No. 2 covered by U. S. Army Specification No. 2-108, it seemed obvious that composition alone would not be the answer. Indeed, it was felt that further efforts in this direction would lead only to a restriction in supply without a compensating gain in quality. The most feasible solution appeared to be a continuation of the compositional aspects of the specification in order to define the broad properties of a good wheel bearing grease and the adoption of a simple performance test to determine what service results could be expected. This was possible because cooperative work with the Grease Advisory Group of the Coordinating Research Council had resulted in the development of a wheel bearing lubricant performance tester.[2] This equipment, which is simple, easily operated and readily available, has been described in previous issues of The Institute Spokesman.[3][4] A more detailed description of the apparatus and method of use is available in an Ordnance Department Tentative Specification.[5]

The adoption of this method will be accomplished by issuing a revision of the present specification to be identified as U. S. Army Specification No. 2-108B. This revision, however, also will retain the compositional features of the present specification for several very cogent reasons. The test evaluates only four factors in wheel bearing lubrication; namely, leakage, formation of deposits, changes in texture and changes in consistency. Obviously, a complete evaluation of all the characteristics of a wheel bearing grease would require a much more complicated test procedure and apparatus if some of them were not tacitly covered by compositional requirements. In addition, the composition outlined in the proposed revision has been found by extensive testing under arctic, desert and tropical conditions to provide greases extremely satisfactory for military use. Finally, it should be mentioned that service tests have demonstrated the necessity for controlling the composition within the proposed limits in order that only one grease will be required for the lubrication of wheel bearings of Army equipment operating under all conditions of climate and terrain.

The compositional part of the proposed specification follows in general the requirement of the existing specification, but enough difference exists to warrant describing it in more detail. Essentially, it covers a No. 2 grade of sodium soap having a 300°F. minimum dropping point and containing a heavy mineral oil. Two per cent of calcium or aluminum soap is permitted, however. The mineral oil content must be between 82 and 90% and must be well refined and conform to the following physical characteristics:

Viscosity, Saybolt Universal at 210°F.	75-100
Viscosity Index, minimum	50
Flash, °F., minimum	350
Pour, °F., maximum	25
Conradson Carbon Residue, %, maximum	2.0

Maximum limits of **0.5%, 0.75% and 0.3%** have been included for the water, free alkali and free fatty acid contents respectively.

The performance test part of the proposed revision of the specification is carried out in accordance with an Ordnance Department Test Procedure [5] referred to previously. In order to be satisfactory, a grease cannot exhibit over 11% leakage when tested by this procedure nor can it form deposits or undergo abnormal changes in texture or consistency. From the standpoint of insuring greases of the desired quality, it would be desirable to employ the performance test on each lot procured. It can be expected that such a practice might lead to considerable difficulty because of the element of personal judgment and experience in deciding what is an abnormal change in texture or consistency.

In order to provide the Army with wheel bearing lubricants of adequate quality, a plan is being adopted to require prior qualification involving all the requirements of the proposed specification and to rigorously inspect each procurement. The latter normally will entail inspection to determine compliance with the chemical and physical limits and to determine performance with respect to leakage and the formation of deposits. In this way, possible difficulties in procurement due to interpretation of changes in texture and consistency can be

avoided since these two criteria will not be considered in inspection testing. Plans have been made to conduct qualification tests at the Rock Island Arsenal Laboratory where the necessary equipment had trained personnel are available for such work. Although the proposed specification has not been finalized, it is expected that such finalization will be accomplished shortly and, therefore, manufacturers who desire to qualify products should feel free to take steps in that direction without awaiting official adoption of the specification. This may be done by submitting a five-pound sample to the Rock Island Arsenal Laboratory.

It is expected that the use of the proposed specification, U. S. Army Specification No. 2-108B will provide the Army with wheel bearing lubricants of much better quality than those heretofore possible under the existing specification. It is expected also that difficulties with wheel bearings attributable to the lubricant will be eliminated or at least reduced considerabl

NOTES

(1) SAE Journal 53, No. 5 (1945), 287-291
(2) The Institute Spokesman VIII, No. 10 (1945)
(3) The Institute Spokesman IX, No. 3 (194
(4) The Institute Spokesman IX, No. 10 (194
(5) Ordnance Department Tentative Specifi tion AXS-1574, "Ordnance Departme Test Procedure For Determining Perfor ance Characteristics of Wheel Bearing Lu ricants."

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Modern Lubrication Methods for Industry

By: C. I. KRAUS, Sales Manager
Alemite Division of Stewart-Warner Corp.

(Continued from April Issue)

With Centralized Lubrication hazards formerly encountered in servicing bearings high above the ground, or at dangerously located points on machinery in motion, may be completely and easily avoided. By connecting bearings with supply lines to one safe and convenient point, complete lubrication is obtained without need for shutting down moving machinery.

FIGURE 10

The true significance of the cost savings made possible through the use of Centralized Lubricating Systems is illustrated by this case concerning a large plant producing corrugated shipping containers (Figures 10 and 11).

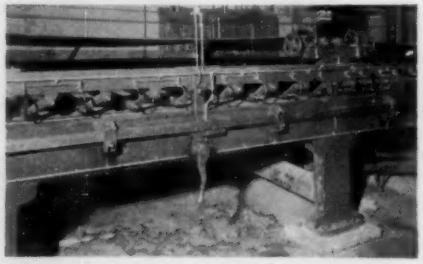


FIGURE 11

In this plant heavy war-time production schedules had overburdened production machinery, resulting in excessive wear and high maintenance cost. The task of lubricating several thousand bearings daily, one at a time, required a considerable daily expenditure for labor. Part of the lubrication job could be done only while the machinery was shut down.

Because of the fact that repairs and resultant lost production had been excessive, Management decided upon the installation of a Centralized Lubrication System for the entire corrugating unit. They decided that savings from the following three factors would amortize the cost of the system in a short time. The savings considered were:

1. Savings from reduction in man hours required for lubrication.
2. Savings in expense for parts and labor for repairs.
3. Savings through the elimination of down time for lubrication.

The results obtained from the installation of Centralized Lubrication effectively reduced over-all production costs. With the Centralized System lubricant is now applied under 3,000-pounds pressure to 720 points along the full length of the corrugating unit from the corrugating machine at one end to the cut-off machine at the other end. Lubricant is pumped through a ½" overhead supply pipe line to six control points along the length of the machine. Each bearing in each group of more than 100 bearings is served by an individual Centralized Lubricating valve. These valves measure the volume of lubricant dispensed to each bearing, thus over-lubrication or under-lubrication have ceased to exist. The entire unit is now more completely and accurately lubricated in just a few minutes' time each day.

In another type of industrial plant, a plant operating 153 vertical lathes, lubrication methods were such that each machine had to be shut down for 16 minutes every eight hours. Consequently, because of inadequate lubrication methods, this producer lost 229 hours of productive time on this group of machines every six days of operation.

Now, since Centralized Lubrication has been installed on the entire group of machines, lubrication is accomplished while the machines continue to produce. More complete and positive lubrication is now obtained in just five minutes' time per machine, principally because all pressure lubricated bearings are serviced from one point on each machine. In this instance Centralized Lubrication added eleven minutes more production time to each machine every eight hours of operation. Thus by improving lubrication methods this producer recovered 153 of the 229 productive hours formerly lost in lubrication maintenance every six days.

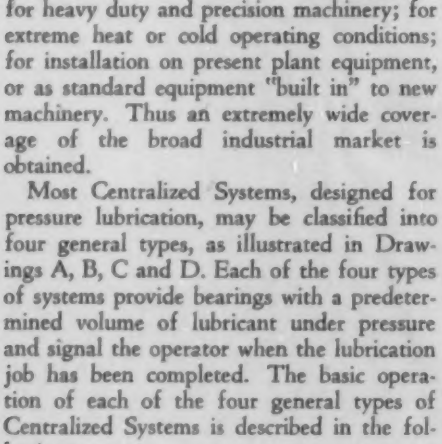
By adding 153 more production hours to this group of machines, the expenditure for Centralized Lubrication was amortized in about 93 days' time. This emphasizes the point that Centralized Systems not only pay for themselves on a dollars and cents basis alone, but they continue to earn a 100 per cent return on the investment, as in this case, every 93 days' time.

It is obvious that the savings cited here are of significant economical importance to

Industrial Management. However, the foregoing figures do not include economies which accrued from other important advantages of Centralized Lubrication. For instance, the figures do not reflect the savings brought about by the elimination of human error—the possibility of bearings being overlooked or over-lubricated. Then, too, the true value of increased safety—the elimination of hazards to workmen—cannot possibly be reported in dollar and cent values.

During the last decade Centralized Lubrication Systems have been progressively improved and designed in construction to the point that present day systems serve the varied requirements in every industry. Although Centralized Systems differ in construction or operation, they serve the requirements for machines lubricated with oil or grease; for both large or small machines; for heavy duty and precision machinery; for extreme heat or cold operating conditions; for installation on present plant equipment, or as standard equipment "built in" to new machinery. Thus an extremely wide coverage of the broad industrial market is obtained.

Most Centralized Systems, designed for pressure lubrication, may be classified into four general types, as illustrated in Drawings A, B, C and D. Each of the four types of systems provide bearings with a predetermined volume of lubricant under pressure and signal the operator when the lubrication job has been completed. The basic operation of each of the four general types of Centralized Systems is described in the following:



TYPE A—SINGLE LINE TERMINATING SYSTEM
(Alemite LubroMeter System)

Individual valves, connected to a single lubricant supply line, automatically provide each bearing with a predetermined quantity of lubricant when the lubricant pump at the system inlet is operated. After all the valves in the system have discharged, an indicator rises signalling the operator that the job is finished. LubroMeter Valves, wherever possible, screw directly into the bearings. This feature, plus the single main supply line running to a dead end, makes this system both easy to install and extremely versatile in application. System handles either oil or grease over a wide range of operating temperatures. The LubroMeter System may be serviced by hand or power guns, either portable or stationary, or it may be made fully automatic with a power gun and electric timing device.

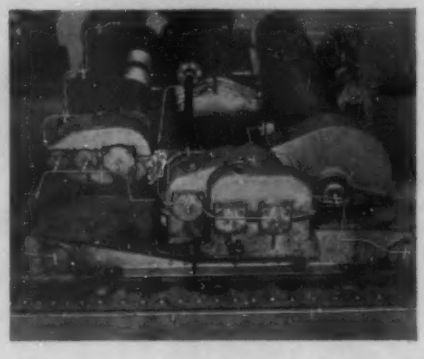
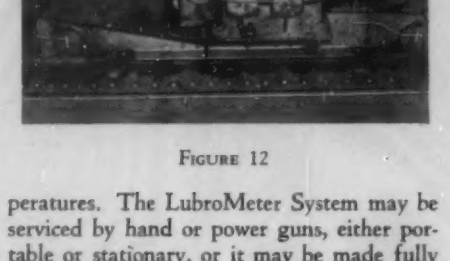


FIGURE 12

Figure 12 shows a typical installation of the LubroMeter System on the trolley of an overhead traveling crane.



TYPE B—MULTIPLE LINE SYSTEM
(Alemite Progressive System)

This system consists of a block of valves which accommodate four different sizes of pistons, the selection of which is based on the amount of lubricant required by the bearings. Individual tubing lines connect each valve outlet to the bearing being served. Lubricant is applied with a portable grease gun, actuating each valve in the block in progressive order, and then causing

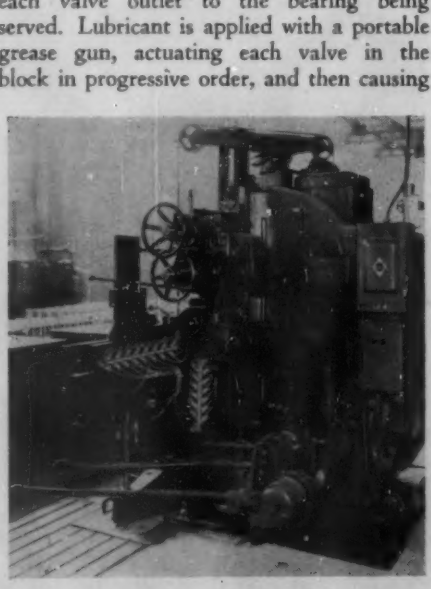


FIGURE 13

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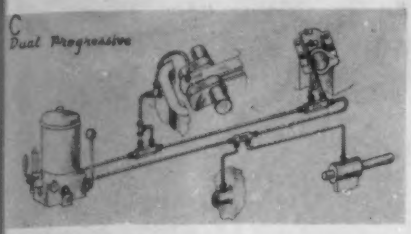
signal to rise indicating to the operator that lubricant has been discharged by each valve through the line to the bearing. A block of valves consists of from three to a maximum of twenty outlets. This system is designed specifically for use with light and medium bodied grease at normal temperatures of plus 50° to 100° F.

Figure 13 shows a typical installation of the Progressive System on a Bullard Vertical Boring Mill.



TYPE C—SINGLE LINE CIRCUIT SYSTEM
(Alemite Dual Progressive System)

Each feeder valve of this system has dual outlets, each outlet being connected to a bearing by means of tubing. A special valve is used at the inlet for reversing the flow of lubricant through the circuit. Lubricant is introduced into the system (at the reversing valve) and progressively operates each feeder valve in the circuit in one direction (serving one-half the total number of bearings), and then returns to the reversing valve where an indicator rises. The operator then moves the handle of the reversing valve to the opposite position, and pumps lubricant through the circuit in the reverse direction until the indicator again rises, delivering a measured amount of lubricant to the other half of the bearings in the circuit. This system is completely enclosed and handles either oil or grease. Valves are fully hydraulic in operation. Drawing shows a hand pump with reversing valve for permanent mounting on or near equipment being lubricated. System may also be serviced by portable grease guns, or it may be fully automatic with a powergun and electric timing device.

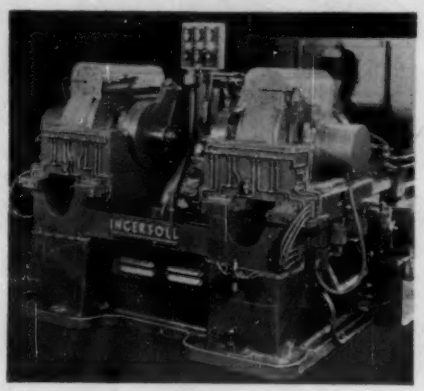
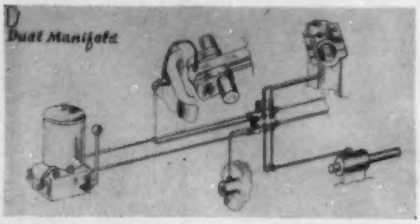


FIGURE 14

Figure 14 shows a typical installation of the Dual Progressive System on an Ingersoll Milling Machine.



TYPE D—DUAL LINE TERMINATING SYSTEM
(Alemite Dual Manifold System)

This system consists of a central pumping mechanism, control valve and indicator, manifold feeder valves (adjustable), and dual lubricant supply lines terminating at the last valve block. When lubricant is pumped into the system the valves operate in one direction, lubricating one-half the bearings in the system, the firing order depending upon the resistance of the bearings. When all the valves have operated, an indicator rises. The operator then moves the handle of the control valve to the opposite position and pumps lubricant through the other line (actuating the valves on the return stroke) until the indicator again rises,

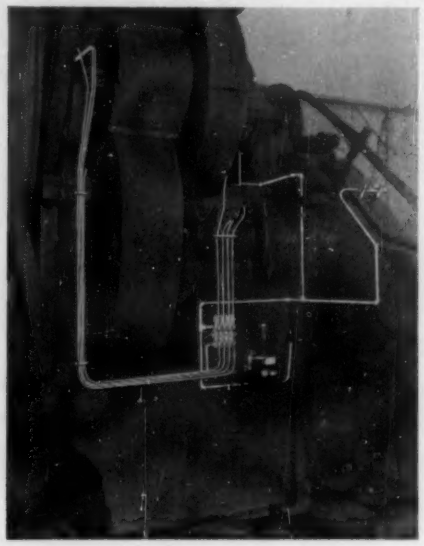


FIGURE 15

delivering lubricant to the other half of the bearings in the system. The feeder valve blocks are available with two, six, eight and ten outlets, each outlet being connected to a bearing by means of tubing. Valves are fully hydraulic in operation, and will handle all types of oil and grease over a wide temperature range. This is a heavy duty system particularly adapted for heavy equipment, or for batteries of heavy machinery to be lubricated from one central point.

Figure 15 shows a typical installation of the Dual Manifold System on a Cleveland Double Combination Punch and Shear. Single line system, valves upper right, are served from the same pump.

In summarizing the need for modern lubrication methods in industry, it should be pointed out that there is little that industry can do about such "fixed costs" as represented by labor, materials and taxes. Therefore, industry must turn its attention to reducing "flexible costs" by adopting improved methods. Accordingly, it is evident that improved lubrication methods can figure prominently in such a program.

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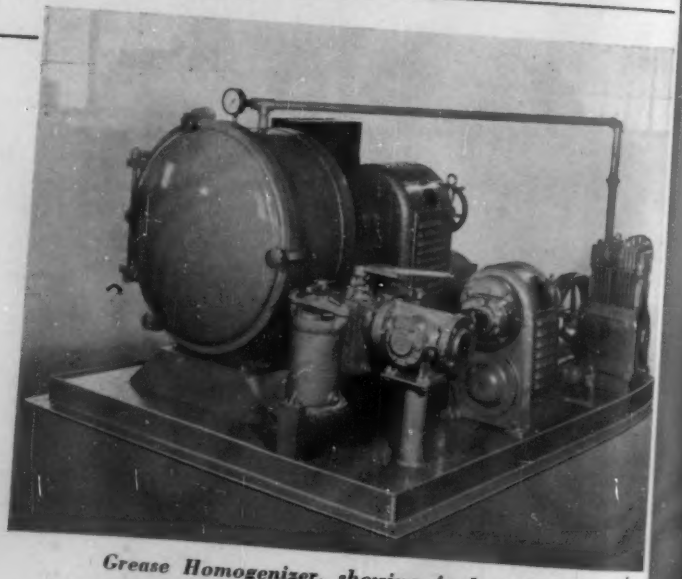

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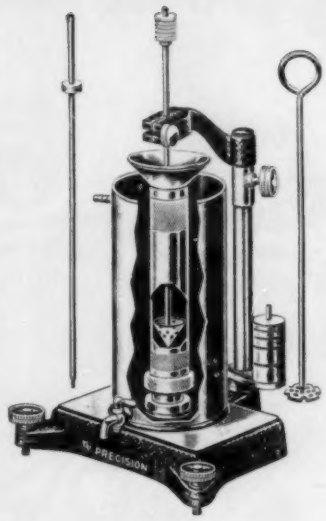

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